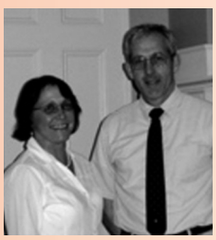
Tangents
News from the Department of Mathematical Sciences
University of Massachusetts Lowell
Fall 2008

2008 Alumni-Awards Banquet

Next Banquet set for May 1, 2009

The 2008 Alumni-Awards Banquet at Cobblestones Restaurant on April 25 was well attended: some forty-five people in all including the college dean, alumni, current and emeritus faculty, adjuncts and students. Attendees came to wine, dine and congratulate our 2008 scholarship winners. Each award winner was given a book prize and certificate in addition to any stipend. The following awards were announced.



Prof. Steve Pennell awarded Catherine Schetky the Bedell-Richardson Scholarship.

Prof. Tom Kudzma awarded Bryan Crompton the Mary Hall Prize.

- Arthur Zamanakos Scholarships
  - Alan Bartlett
  - Michelle Polys
  - Marco Bonnett-Matiz
- Shapiro Scholarship: Richard Vo
- Richardson-Bedell Scholarship: Catherine Schetky
- Mary Hall Prize: Bryan Crompton

The 2008 UML Modeling Team consisting of Melissa Spencer, Alex Frieden, and Elliott Moy was recognized by Kiwi Graham-Eagle.

The 2009 Alumni Reception/Awards Banquet will be on May 1 at the Olympia Restaurant, 453 Market St, Lowell. All alumni are welcome to attend. Visit http://faculty.uml.edu/math for details.

Book Review—*The Cat In Numberland*

The following book review by our own Prof. Jim Propp is scheduled to appear in the January 2009 issue of the Notices of the American Mathematical Society, and appears in Tangents with permission from the AMS.

The Cat in Numberland
Ivar Ekeland,
illustrated by John O'Brien
Cricket Books, 2006
(reading level ages 9-12)
US $19.95, 56 pages

"The Cat in Numberland" is a well-thought-out and stylish attempt to present ideas about infinity to children who are ready to take a step beyond the notion of infinity as "the largest number." I found Ekeland's text engaging, with enough whimsy to keep the story from being dry but not so much as to be cutesy or condescending, and I thought O'Brien's charming black-and-white illustrations compensated for their lack of color through their loopy, nervy vigor.

There's something mind-numbing about the concept of infinity, and for many students, even the word itself invites a retreat from forward-moving thought into static wonder; so, when leading a first-timer on a trip to infinity, it's best to use the word as little as possible. Ekeland borrows a famous pedagogical device from David Hilbert's popularization of Cantor's ideas about infinity, namely the idea of a hotel with infinitely many rooms, but even though Ekeland's hotel is called "Hotel Infinity," you will not find any other occurrence of the words "infinity" or "infinite" in his book. Ekeland honors Hilbert by making him the proprietor of this hotel on the planet of Numberland, though the character's fastidiousness, quarrelsomeness, and lack of creativity make this homage a mixed compliment at best. Where Ekeland departs from Hilbert is his fancy that the guests in the hotel are not people but the actual numbers One, Two, Three, etc., personified. The number One starts out in room 1 of the hotel, the number Two starts out in room 2, and so on. The use of names for the numbers, and numerals for the rooms they occupy, at first struck me as strange, but I later realized that this is an astute authorial choice that wards off numerous potential confusions.

The plot is driven by the difference between the temperaments of Mr. Hilbert and his wife (Mr. Hilbert wants to keep all the room occupied, while Mrs. Hilbert wants to admit new guests), and all the puzzles that the Hilberts

Continued on page 4

Steve's Sector

Spring 2008—From the Chair

It has been an eventful summer and fall. The department was fortunate enough to have Cori Lee join us as our Staff Assistant this summer. Cori will be dividing her time between our department and the Department of Environmental, Earth, and Atmospheric Sciences. Before joining us, Cori had worked in both the Accounts Payable department of the university and the Graduate School of Education. Welcome, Cori.

Congratulations are in order to several people:

- Professor Konstantin Rybnikov was recently awarded tenure and promoted to the rank of Associate Professor.
- Professor Jim Propp and his wife Sandi Gubin have a new daughter, Eliana Isabel Propp-Gubin, born October 5.
- Professor Enrique Gonzalez-Velasco's new book, tentatively entitled *Journey through Mathematics: Creative Episodes in its History,* has been accepted for publication by Springer-Verlag.

Steve Pennell

Our spring graduates are Mark Andrew Atwood, Ryan Michael Beaven, Jennifer M. Cole, Stephen John Dalton, Gregory P. Hampton, Brian Joseph Intoccia, Michelle Polys, Euriene Rodriguez, Mark Saba, and Paul Warren.
Our summer graduates are Daniel Charles Gauvin, Bhuvana Kaushik, Keith McElroy, and Catherine Schetky.

Math Department faculty members have been literally traveling the globe attending conferences and giving presentations on their research. Last summer Professor Alexander Kheifets worked with colleagues in Kiev, Ukraine, and gave a presentation at a conference in Poznan, Poland. Professor Raj Prasad gave a talk in Rennes, France this summer. Professor Ravi Montenegro was one of three mathematicians invited to give presentations at a workshop at the Tokyo Institute of Technology in September, and he was invited to give a presentation at the Georgia Institute of Technology in October. Professor Konstantin Rybnikov recently returned from giving a talk at a conference in Kiev. Professor Dan Klain traveled to Halifax, Nova Scotia, in October to give a series of talks at Dalhousie University. Professor Tibor Beke is on sabbatical leave this semester working with colleagues at Columbia University and Princeton University. Professor Jim Propp traveled to Montreal in July to give two invited presentations at an international conference. Professor Alexander Samarov is on sabbatical leave both fall and spring semesters. He is working with colleagues in the Departments of Statistics at Tel Aviv University, at Hebrew University at Jerusalem, and at the Institute of Applied Mathematics "Mauro Picone" in Naples, Italy.

This year our department is undergoing our Academic Quality Assessment and Development (AQAD) review. As stated on the Office of Academic Affairs web page, each department is reviewed every seven years in order "to assess and improve the core academic functions of teaching and learning, research/professional/creative activity, and public service/academic outreach through an ongoing system of quality control/program assessment." We are in the process of compiling a department self-study, and we will be visited by a team of external reviewers in the spring. If you have any comments about your experiences with our department, we would love to hear from you. Please email me at stephen_pennell@uml.edu or write to me at Department of Mathematical Sciences, University of Massachusetts Lowell, Lowell, MA 01854. Thank you.

Please keep in touch, and stop in to visit the next time you are in the area. Remember to check out our web site for items of interest.

What Are You Up To?

Want to keep your classmates up to date on what you're doing and where you are? Take a few moments to tell us where you are, and whatever else you might like to share.

We can be contacted by mail at Department of Mathematical Sciences, North Campus, UMass Lowell, Lowell MA 01854. Telephone: (978) 934-2410. Email: mathematics@uml.edu

You might also wish to contact our Office of Alumni Relations, Southwick Hall 250, UML North, Lowell MA 01854-3629. Toll free telephone: (877) UML-ALUM. Email: Alumni_Office@uml.edu

The Mathematical Sciences Web Page

Have you visited the Mathematical Sciences Web page lately? The address is http://www.uml.edu/ dept/math — but don't worry if you forget it. If you "Google" the phrase "UML Math," the first result will be our Web page

Steve Pennell, Chair

Writers: Ken Levasseur, Raj Prasad, Ann Marie Hurley, Dan Klain, Guntram Mueller, Alex Olse, Marv Stick and Kiwi Graham-Eagle

Tangents is produced biannually by the Publications Office for the Department of Mathematical Sciences. Your comments are welcome.

The *Tangents* Problem

This problem is taken from projecteuler.net, a source of many nice computational problems. This is one you will definitely want to attempt with a computer.

Peter has nine four-sided (pyramidal) dice, each with faces numbered 1, 2, 3, 4. Colin has six six-sided (cubic) dice, each with faces numbered 1, 2, 3, 4, 5, 6.

Peter and Colin roll their dice and compare totals: the highest total wins. The result is a draw if the totals are equal. What is the probability that Pyramidal Pete beats Cubic Colin? Give your answer rounded to seven decimal places in the form 0.abcdefg.

Up to four correct solutions from among all that are submitted by February 15, 2009 will earn the solver a "UML Math" T-shirt. You may submit your solution to mathematics@uml.edu or mail it to Ken Levasseur, Department of Mathematical Sciences, North Campus/Olney Hall, UMass Lowell, Lowell MA 01854.

Solution to the Fall 2007 Problem

(i) **An Efficient Ruler.** Given a blank piece of wood of length 15 inches, find the minimum number of marks you need to make in order to be able to measure each whole number from 1 inch to 15 inches *directly.*

(ii) **A Ruler Game.** Two players start with a blank piece of wood of length 15 inches. They take turns to make a mark at one of the fourteen points which measure a whole number of inches. The winner is the first player to produce a ruler which can measure each whole number from 1 inch to 15 inches *directly.*

(iii) **Generalize** (i) and (ii) to an n inch piece of wood.

Solution for 15 inch rulers:

Five marks are sufficient to measure with a 15 inch piece of wood. One of the 80 different ways to mark the wood is 1, 2, 3, 4, and 10 inches from one edge. With those marks, you can measure all integer lengths up to 15. Four marks will never be sufficient. Besides the four marks, if you include the two ends of the wood, there would be "6 choose 2" or 15 different lengths that could be possible. However the 15 lengths can't be distinct. To see this, observe the following.

1. To measure 14 inches, the wood must be marked one inch from one edge, at A.

2. If we want to avoid duplicates, measuring 13 inches requires that we mark the wood two inches from the opposite edge, at B.

3. Now to be able to measure 12 inches, we must mark the wood 3 inches from one of the ends, at C or D. At either end this will duplicate the one or two inch measurements.

Faculty Update—Brendan Fleming

Emeritus Professor Brendan Fleming was recently interviewed by Prof Alex Olsen.

This writer recently had an enjoyable conversation with retired Professor Brendan Fleming who will be 83 in February 2009. He taught for over 42 years in the Mathematical Sciences Department with a specialty in Probability and Statistics and Data Analysis. He was a pioneer in teaching with statistical software such as Minitab and SPSS, which he used in consulting as well.

Brendan never missed a single class in all of his years at LTI/UL/UML, and reports that his children helped him maintain that record by being born on the weekend. He reports that he enjoyed every minute of his teaching career and especially making statistics understandable to nursing students—two of Brendan's daughters graduated from the University as nursing majors.

It is sad to report that on November 26, 2007, Brendan's beloved wife of 58 years, Bernice, died in his arms of a massive heart attack. Brendan says that he greatly misses his wife and their companionship of 65 years and is proud that they never had angry words between them for the entire time. The Flemings had 7 children and have 14 grandchildren. He is very proud of his family. One grandson, Brian, is currently the senior class president at Chelmsford High where he is ranked near the top of his class, is the captain of both the football and baseball teams, and an award recipient in basketball. Most importantly, Brian plans to major in mathematics in college. It should be noted that Brendan's son Marty, a math major alumnus of the University, is now a vice president with IBM, living in Connecticut. Brendan is pleased to tell of the service to our country by his son Eddie, a WestPoint graduate and Lieutenant Colonel in the Army, and a grandson, Andy (also a WestPoint Graduate) who has served two tours in Iraq.

Since retiring, Brendan spends a significant amount of his time as a volunteer, assisting the needy as part of the efforts of the Society of St. Vincent DePaul.

Continued from page 1

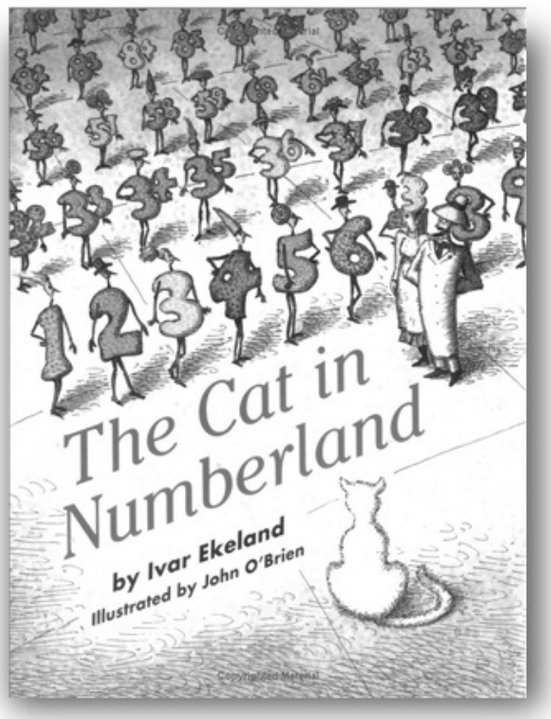
Book Review—*The Cat In Numberland*

and their guests tackle are driven by the pursuit of marital harmony. The tension between Mr. and Mrs. Hilbert as described by Ekeland is just one instance of a fictionalizing touch that might at first seem to pull the story away from mathematical issues but actually plays a pedagogical role. Another example is the discussion in Chapter 1 of the "games" (addition, subtraction, multiplication, and division) that the numbers play with one another; this leads to a seemingly incidental discussion of odd and even numbers that lays the groundwork for the problem faced in Chapter 4 (how can you keep the hotel full when infinitely many guests leave?). Likewise, the discussion of how the letters A through Z attempt to participate in these games, while it plays no role in later developments in the book, serves as a nice preparation for the idea of using a letter as a place-holder, which the young reader will encounter when starting the study of algebra.

The climax of the book occurs in Chapter 5, when the hotel must be made to accommodate an infinite number of new guests, the Fractions, who arrive in an infinite rectangular two-dimensional array, each of whose rows is infinite. The solution to this problem comes from a change in perspective, quite literally: the number Zero, by looking out the high window of Room 1,234,566, is able to see his old hotel-mates and all the new arrivals as forming a triangular array each of whose rows is finite, which makes it possible to fit them into the hotel.

If you have a copy of the book available, jump immediately to page 55 for a masterful visual rendition of the key idea. The scene can be parsed in two different ways, and the viewer can go back and forth between them: now you see it, now you don't, now you do again. "I see it now!" says Mr. Hilbert. "But we could not see it from where we were standing." This is a fine motto for every stage of the process of learning mathematics, from pre-kindergarten to post-graduate. Each time we make a conceptual advance, we should jump back and forth across the divide we have crossed, to understand what made the leap so difficult the first time and so easy afterward, with the goal of enabling ourselves to make other jumps with less trouble in the future.

I have one mathematical quibble with this otherwise excellent little book, namely, the description of the layout of the hotel. We are told in Chapter 1 that there is a first room, which is Room 1; but we are also told that each odd-numbered room lies between two even-numbered rooms and vice versa (and there is no Room 0, at least at the outset). This inconsistency



is easily fixed by treating Room 1 as an exception, but what are we to make of the fact that Hotel Infinity has infinitely many floors? If Room n lies between Room n -1 and Room n +1 for all $n > 1$ (as is strongly implied by the text), then which numbers are on the hotel's higher floors? Indeed, you can lead any young reader to see that Rooms 1 through 1,234,566 must all be on the ground floor, so that room 1,234,566 cannot play the pivotal role required by the plot. And, leaving that aside, if there were infinitely many floors, why couldn't the whole numbers and fractions be accommodated by putting the whole numbers on the ground floor, the fractions with denominator 2 on the second floor, the fractions with denominator 3 on the third floor, etc.?

Since this is a work of fiction designed to awaken the imagination, I view these imperfections of the book as a plus, not a minus; if you know a child who likes this book, you might try to lead him or her to discover these inconsistencies with a little bit of Socratic prodding (and perhaps challenge the child to redesign the hotel in various ways). At some point or other, the question may arise whether there could be a hotel with more than one floor such that Room n lies between Room n -1 and Room n +1 for all n. At this point, the child might embark on a project equivalent to proving the axiom of induction,

Continued from page 4

Book Review—*The Cat In Numberland*

and experience both confusion and frustration. This would be an excellent occasion for explaining that when we learn or create mathematics, confusion is often a good thing: it means we have understood a tension between two opposed ideas that some must somehow be reconciled. Indeed, if you are a mathematical researcher, you might explain to the child that the way you make a living is by finding good things to be confused about and then trying to un-confuse yourself.

The topic of confusion leads us to the title character of the book, the unnamed cat, who is the reader's surrogate, and who can serve as a stand-in for both the future mathematician and the future non-mathematician. The cat's role is to express puzzlement at what is really going on, when everyone else seems content that a solution has been found. The cat can see that the move-everyone-to-the-next-room trick has worked, but is mystified as to how the trick works. Since all the rooms were full before, and all the rooms are full now, and one new guest has been accommodated, there must be a new room in the hotel somewhere—but where is it? Ekeland wisely does not introduce a character to resolve the cat's confusion. Some confusions need to be left unresolved, and revisited from year to year as we gain new ways of thinking.

Most mathematicians, as young students, played the role of the cat at one time or another, feeling (and perhaps voicing) confusion in a classroom situation in which the other students, who were satisfied with a more superficial level of understanding, didn't see anything to be confused about. Our schools need teachers who understand that confusion can sometimes be evidence of a deeper approach to the subject matter. Indeed, who can say how many potential mathematicians were driven away from mathematics at an early age by classmates and teachers who made them feel stupid for feeling rightly confused about deep matters? In the end, the cat opts to leave Numberland for a place that is easier to understand, namely, our own world (more specifically, Corsica—which may be an arbitrary or personal choice of Ekeland's, or may hold some meaning that eludes me). The cat still dreams of Numberland, but she enjoys living in a place where puzzlement is not a fact of daily life.

Most mathematicians, as young students, played the role of the cat at one time or another...

Like Alice, or the Dorothy of the MGM version of "The Wizard of Oz", the cat's sojourn in a land governed by strange rules has given her a heightened appreciation of the mundane (though unlike Alice or Dorothy, she ends up on Earth as a refugee, not a returning native).

In this final stage of her journey, the cat strikes me a stand-in for the student who retreats from the counter-intuitive constructs of abstract mathematics in favor of the concrete and the graspable. Whether these students become engineers or accountants or artists, what we mathematicians hope for them is not that they become good at solving fanciful puzzles like the ones the Hilberts face, but that they accord some respect to the challenge of these puzzles, and that, in some corner of their minds, they have an esthetic response to such puzzles and their solutions. Such "dreams of Numberland" should be part of the residue that students are left with after their mathematical education is completed.

We should not expect all of our students to want to live in Numberland, or even to visit very often, but we should hope they will acquire the view of mathematics that is tacitly advertised by Ekeland and O'Brien: a view of mathematics as not just a mountain of facts but also a fountain of paradox.

Alumni Update

Jean Cafeteiro (B. S., 1976) has completed 20 years as an eighth grade math teacher at Lakeview Junior High in Dracut, MA and is Treasurer for the Dracut Teacher Association. Jean has 3 adult children. Two graduated from UMass Lowell in 2007.

Dennis Goyette (B. S. 1982, M. S. 1984) writes: "I am currently living in New Hampshire and I am a mathematics curriculum developer for Johns Hopkins University's Talent Development High Schools program. I am also an online mathematics instructor for Southern New Hampshire University, I teach mathematics online for New Hampshire's new Virtual Learning Academy Charter School (VLACS), I also teach online for Craig School District in Craig, Alaska, and will be teaching online in the fall for New Mexico's online high school. I went into education after being laid off, two weeks after 9/11, from my job as a software developer. I had worked over 18 years in the computer industry as a software developer and consultant. My daughter just graduated from New England College with a BA in Business Administration (minors in Accounting and IT)."

Donna Dietz (M. S. 1995) recently earned tenure and a promotion to Associate Professor of Mathematics at Mansfield University.

Anu Karna (M. S. 1998); earned a Doctor of Education degree in the area of Leadership in Schooling from UMass Lowell in 2007. Her dissertation was entitled: "Analysis of Cognitive Intake for Survey Research/ Sampling Distribution/Design and Development of a Mathematical Model on Emotion-based Survey Results."

Julie A. Arloro-Mehta (M. S. 2006) writes "Just returned from Southern California and I am now residing in North Andover. I am working for Lockheed Martin in Lexington doing work as a subcontractor at MIT Lincoln Laboratory in Missile Defense. I also had a son in April 2007."

Mark Atwood (B. S. 2008) has been hired to do statistical work for Wolfram Research, Inc.

Catherine Schetky (B. S. 2008) gave a talk on data mining to department students and faculty on October 1, 2008. She has just started working for a database marketing firm in Lexington, MA.

Bhuvana Kaushik (B. S. 2008) is taking classes in the College of Education and teaching pre-algebra at the Bartlett School in Lowell.

Thanks For the Contributions!

Our thanks to all who have contributed to the Department of Mathematical Sciences over the past few years. Your generosity has allowed us to make purchases, award scholarships, and engage in activities that would otherwise have been impossible.

Many of you have responded generously to UML phonathon and other fundraising contacts. These requests can benefit the Department of Mathematical Sciences directly if you specify that you wish to have your gift directed to Mathematics. Otherwise it will provide valuable assistance to the University at the College level.

Tangents
Department of Mathematical Sciences
University of Massachusetts Lowell
Olney Hall
UML North
Lowell, MA 01854

Non-Profit Org
U.S. Postage
PAID
Lowell, MA
Permit No. 69